

12/13/16

"Champions keep playing until they get it right."-Billie Jean King

HW: "Increasing and Decreasing" w/s  
Test 2 on Tuesday 12/20

AIM: When are functions increasing/decreasing?

Warm Up:

1) Find the absolute max and min of the following Use the interval  $[-3, 3]$ :

$$\begin{aligned}y &= x^3 - x + 1 \\y' &= 3x^2 - 1 \\3x^2 - 1 &= 0 \\ \sqrt{x^2} &= \sqrt{1/3} \\x &= \pm \sqrt{1/3}\end{aligned}$$

$$\begin{aligned}f(3) &= -23 \quad \text{MIN} \\f(3) &= 25 \quad \text{MAX} \\f(\sqrt{1/3}) &= .615 \\f(-\sqrt{1/3}) &= 1.38\end{aligned}$$

For each problem, find the x-coordinates of all critical points, find all discontinuities, and find the open intervals where the function is increasing and decreasing.

2)  $y = x^3 - 11x^2 + 39x - 47$

$$y' = 3x^2 - 22x + 39$$

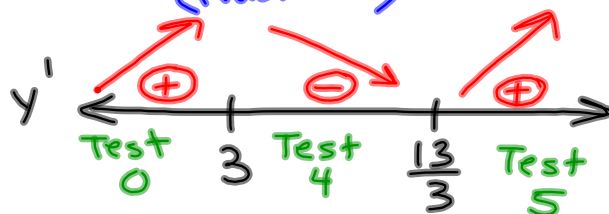
$$0 = 3x^2 - 22x + 39$$

$$0 = 3x^2 - 9x - 13x + 39$$

$$0 = 3x(x-3) - 13(x-3)$$

$$0 = (3x-13)(x-3)$$

$$x = \frac{13}{3} \quad | \quad x = 3$$



$$3(0)^2 - 22(0) + 39 = 39 \oplus$$

$$3(4)^2 - 22(4) + 39 = -1 \ominus$$

$$3(5)^2 - 22(5) + 39 = 4 \oplus$$

Increasing:  $(-\infty, 3) \cup (\frac{13}{3}, \infty)$

Decreasing:  $(3, \frac{13}{3})$

If  $y' > 0$  The function is increasing

If  $y' < 0$  The function is decreasing

## Steps to Determine where functions are increasing/decreasing

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- 1) Find the derivative
- 2) Find the critical values
  - a) Set derivative = 0
  - b) Set denominator of derivative = 0  
(only when fraction)
- 3) Set up Derivative Number line  
using the critical values
- 4) Test the intervals by plugging  
test values into the Derivative.
- 5) If derivative is
  - a) Positive  $\rightarrow$  function is increasing
  - b) Negative  $\rightarrow$  function is decreasing.

$$3) \ y = -x^4 + 3x^2 - 3$$

$$4) \ y = \frac{x^2}{4x + 4}$$

$$5) \ y = \frac{3x^2 - 3}{x^3}$$

$$6) \ y = (2x - 8)^{\frac{2}{3}}$$

$$7) \ y = -\frac{1}{5}(x-4)^{\frac{5}{3}} - 2(x-4)^{\frac{2}{3}} - 1$$



